Notice to Reader.—When you finish reading this magazine, place a 1 cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed overseas. No wrapping—No Address. *A. S. Burleson, Postmaster-General.*

SCIENCE

NEW SERIES
VOL. XLVIII No. 1244

FRIDAY, NOVEMBER 1, 1918

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $5.00

NEW (2d) EDITION
USED IN S. A. T. C. COURSES

Keefer's Military Hygiene and Sanitation

Colonel Keefer's book is being widely used as a text-book in schools and colleges giving the S. A. T. C. Course.

The new edition of this work has been thoroughly revised so as to include all the latest advances developed by the War in Europe. It has chapters on care of troops, recruits and recruiting, personal hygiene, physical training, preventable diseases, clothing, equipment, foods, water supply, disposal of wastes in garrison and camps, sanitation of posts, barracks, transports, marches, battlefields, trenches; tropic and arctic service, venereal disease, alcohol and other narcotics.

12mo of 340 pages, illustrated. By COL. FRANK R. KEEFER, Medical Corps, U. S. Army. Cloth, $1.75 net

Whiting's Bandaging

12mo of 151 pages, with 117 illustrations. By A. D. WHITING, M.D., Instructor in Surgery at the University of Pennsylvania. Cloth, $1.50 net.

This work takes up each bandage in detail, telling you and showing you how to apply the bandage.

Goodnow's War Nursing

12mo of 172 pages, illustrated. By MINNIE GOODNOW, R.N., War Nurse in France. Cloth, $1.50 net.

A record of two years' service as nurse in the war zone, giving first hand information.

Stokes' Third Great Plague

12mo of 204 pages, illustrated. By JOHN H. STOKES, M.D., Head of Section on Dermatology and Syphilology, The Mayo Clinic. Cloth, $1.75 net.

A timely book for soldier, sailor, social economist, physician, and all those interested in welfare work.

Bergey's Hygiene

SIXTH EDITION

Octavo of 543 pages, illustrated. By D. H. BERGEY, M.D., Assistant Professor of Hygiene and Bacteriology, University of Pennsylvania. Cloth, $3.50 net.

A standard work covering every division of hygiene and sanitation, with much collateral information.

W. B. SAUNDERS COMPANY Philadelphia and London

Spencer Microscopes

Our entire output of Microscopes is temporarily taken by the Medical Divisions of the U. S. Government. We are happy to thus dedicate our facilities to the winning of the war.

Although unable to accept further orders just now for Compound Microscopes, we are able to supply a limited number of Microscope Accessories, Microtomes, Dissecting Instruments, etc. Information given on request.

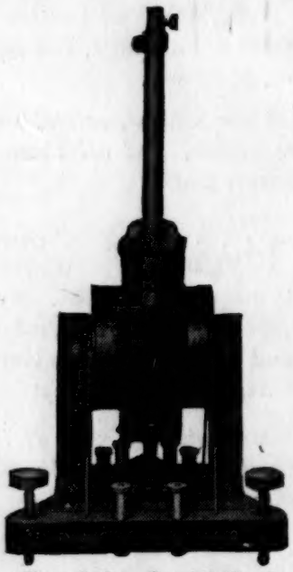
SPENCER BUFFALO U.S.A.

SPENCER LENS COMPANY

BUFFALO, N. Y.

SPENCER BUFFALO U.S.A.

Northrup Alternating Current Galvanometer

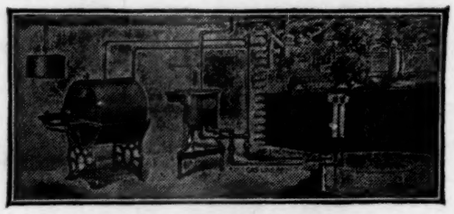


Described in Circular No. 7

Pyrolectric Instrument Co.

148 E. State St. Trenton, N. J.

GAS—GAS



The "Detroit" Combination Gas Machine

Automatically makes the best and cheapest gas for

Laboratory Uses of Every Character

Heating—Cooking—Lighting

Over 30,000 in daily use

Descriptive catalogue and names of users in your locality sent on request

THE DETROIT HEATING & LIGHTING CO.

612 Wight St. Detroit, Mich.

Established 1868

SCIENCE

FRIDAY, NOVEMBER 1, 1918

CONTENTS

The Balance, the Steelyard and the Concept of Force: DR. WILLARD J. FISHER 427

The Scientific Members of the British Educational Mission 433

William John Keep 437

Scientific Events:—

Science and Industry in Tasmania; Manganiferous Ore in Oregon; Exhibit of Minerals useful in War; Library of the Edgewood Arsenal Laboratory; Endowment of Engineering Research 438

Scientific Notes and News 442

University and Educational News 441

Discussion and Correspondence:—

The Scientific Name of the Passenger Pigeon: HARRY C. OBERHOLSER. *Alleged Rediscovery of the Passenger Pigeon:* JOHN M. CLARKE, S. M. RASMUSSEN. *Do we want a Great Private Institution for Inventors like the Institute of France for Artists?* DAVID FAIRCHILD. *Circular Frequency:* PROFESSOR ARTHUR TABER JONES 445

Scientific Books:—

Armsby on the Conservation of Food Energy: PROFESSOR GRAHAM LUSK 447

The Flora of North Dakota: O. A. STEVENS. 448

Special Articles:—

Pear Blight Wind Borne: PROFESSOR F. L. STEVENS, W. A. RUTH, C. S. SPOONER..... 443

MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

THE BALANCE, THE STEELYARD AND THE CONCEPT OF FORCE

THE primitive philosophy of *Animism*, "the doctrine that a great part, if not the whole, of the inanimate kingdom, as well as all animated beings, are endowed with reason, intelligence and volition, identical with that of man," still to a degree sticks in mechanics, in the concept of force. Schopenhauer is quoted as saying:

> That the essence of forces in inorganic nature is identical with the will in us, every one believes with full certainty and as a demonstrated truth, who seriously considers it.

R. Eisler says:

> Force is a concept which gets its content originally from the capacity of the ego in general by means of its will to bring about something, to overcome a resistance, and is then immediately superposed upon the objects of the external world. . . . Since the ego finds limits to its activity in the external world, feels itself hindered by objects, it inevitably interprets the hindrance as the expression and activity of a sort of will-power analogous to itself which things exert against it and by virtue of which they can or do influence other things. . . .

E. Mach says that the concept of force is a survival of fetishism; Kirchhoff, in the famous prefix to his Mechanics, acknowledges the value of the older view in the development of the science, and its usefulness in elementary teaching, but takes for himself this higher ground:

> I propose as the problem of mechanics, to describe the motions which occur in nature, and, forsooth, to describe them completely and in the simplest way. I will further add that it should deal only with this, to state what the phenomena are, not to determine their causes.

For him the term force "forms only a means of simplifying the forms of expression, *i. e.*, to express in brief phrases equations which with-

out the use of this name could only with difficulty be expressed in words."

Believing that the history of a growing concept is sometimes an aid towards a teacher's understanding of his students' difficulties. I have been interested in forming a conjectural reconstruction of the history of this force concept, from the hidden days of pure animatism to the time when a distinct separation between matter and force concepts began to show itself; helping myself meanwhile with such facts as archeology scantily shows us about the most ancient tools, contrivances and ways of life.

To put the problem as a question: When and how was it learned that very different objects may have the same weight? That the same object may have different weights? To treat of force mainly in the weight form is no wrong, on account of the universality of gravitation and the fact that forces even to-day are measured mainly in terms of weight.

The second question is quickly answered; before Richer in 1673 returned to Paris from Cayenne with a report on the going of his clock in the two places, no one had suspected a variability of weight; Huygens concluded from this report that bodies in high latitudes fall faster, and are heavier, than in low; but even now this conclusion remains a deduction from refined instrumental observation; no mason's assistant can say from his personal experience that it is harder to lift a hod of bricks in Edinburgh than in Quito. To us all, the weight of a thing is constant.

That different objects may have the same weight is an extremely ancient idea, so familiar as to be a truism, I dare say, even to the pyramid builders and their forefathers. But I suppose that even truisms were once discoveries; this one, perhaps, became the property of man because he labored.

Assuming that sensations of effort are real, I would classify them, perhaps naïvely, in three groups: Sensations of

(*a*) Effort proper—central, which go with the sending of the nerve message from the central nervous system.

(*b*) Stress—the nerve message reaches the muscles, they contract, their changes in form affect the sensory endings of themselves and of neighboring parts, as the skin, the joints, etc., by virtue of arterial and venous compression, the circulation and the breathing also are affected, and, through them, distant parts of the body.

(*c*) Yielding—*changes* in stress occur when external bodies give way to the muscles and bones, or when the body itself is moved, as in jumping.

Normally (*a*) and (*b*) go together; in nightmare most of us have felt the will paralyzed, the body apparently not responding to the centers; in paralysis the separation may be permanent; I have read that the separation occurs in curare poisoning, when the motor nerves no longer actuate the muscles, but consciousness and sensation remain.

But (*c*) varies with the object dealt with, and also, for the same object, with bodily health and tone. It varies with the way the object is dealt with. Its variations, combined with the evidence of other sensations, enable us to distinguish between the self and the not-self, and between the parts of the not-self, of the external world. With (*a*) and (*b*) but without (*c*) we would know little of the mechanical qualities of bodies. With (*c*) we get notions of bodies differing not only in color, odor, etc., but also in weight; for to move objects, whether to lift, carry or throw them, requires effort, and the efforts for lifting, carrying and throwing a given body are of the same order of magnitude. Like bodies of about equal extent require like efforts; like bodies of unequal extent require unlike efforts; but equal extent does not condition equal efforts; *e. g.*, a block of wood and a boulder. So we can add to the differing qualities of bodies given by sensations of color, odor, etc., weight and specific heaviness. This effort-demanding quality, varying among bodies and with the condition of the person, would early be abstracted, and the concept weight would appear, in positive (heavy) and comparative (heavier, lighter) degrees. Weight was found to be a quality of solids and liquids universally; the sensations of effort have not yet

made it apparent to us in the case of air, and Galileo first showed it there by experimental means—weighing compressed air—which appeal to other senses and to the reason. The savage laborer would have a rough idea of equality in his backloads, he might recognize this equality in backloads of venison or firewood, he might count backloads, bucks or arrows, and so attain crude notions of ratios, and in all things he would perceive the demand for effort, and so recognize the existence of *heavy matter* of all sorts; the sorts all being alike only in this effort-demanding quality.

Knowing effort only through the sensations of effort, which are subject to Weber's law, and through that form of hysteresis called memory, we can compare efforts, and the weights to which they correspond, only very crudely for equality, practically not at all for ratio, and with diminishing accuracy after longer intervening times. However, efforts being apparently equal, so are weights assumed to be, and, vice versa, bodies of like material and the same size are taken to have equal weights without "hefting them." One rabbit is about as big and so weighs about as much as another.

That two rabbits weigh twice as much as one, however, is not an experience, but a judgment. The effort sensation for two rabbits is not in any sense double that for one; if a man can lift a side of beef with great effort, is the effort required to lift two sides at once twice as great, when he perhaps can not lift the two sides at all? Is the effort made by a stronger man who lifts the two double that of the weaker lifting one?

A very ancient method of bearing loads, dating back to prehistoric times and portrayed in the most ancient records, is the carrying stick or yoke. Convenience and comfort in using this are greatest when the bearer is at the center, which is when equal numbers or volumes of like things swing from the two ends. This, I suppose, led to the invention of the balance with equal arms as a more refined and objective, more "honest," means for the inverse purpose of testing equality in respect to this effort-demanding quality, *weight* or *quantity of matter*. One Greek name for the balance is ζυγόν, yoke; but the implement itself dates to measureless antiquity. H. L. Roth,[1] quotes Mr. Ivan Chien, of the Chinese Legation in London, to the effect that Chinese history assigns the making of scales to the reign of the Emperor Fu Hi, B. C. 2956. Baumeister (Denkmäler) says it was known in Homeric times; excavations in Crete show that in the recently uncovered civilization of its people the balance was used; Egyptian hieroglyphics show it in ancient use. As the beam was commonly of wood it has not been preserved from those early days.

But why should people desire a more objective, more honest, means of comparing things than by "hefting" or counting? I take it, because of trade, whose routes were marked in Europe even in the Stone Age (as is known from the migration all over the continent of flints of identifiable origin). When the trade in metals grew up, accuracy and standards became of an importance hitherto unprecedented and with them arose the balance and calibrated weights. Lepsius[2] is referred to as figuring a sliding weight on a balance beam of ancient Egypt; I have not seen the figure; one would assume that such a sliding weight, serving perhaps as a handy tare, might have suggested the next improvement in weighing apparatus, the steelyard. Whether it did or not must remain for a while unknown; for the only authorities accessible to me are irreconcilably in contradiction as to the date earliest recorded of the Roman steelyard.

There are two forms of steelyard, the Danish and the Roman. The former seems once to have been very common. Sökeland[3] describes a large variety, from simple clubshaped sticks to elaborately worked metal pieces. It was slung by a cord; the unknown weight hung from another cord fixed near one end, and the more or less heavy knobbed or swelling end beyond the fulcrum balanced the unknown.

[1] *Jour. Roy. Anthrop. Inst.*, 47, 1912.

[2] Denkmäler, III., 39, No. 3.

[3] Translated in Smithsonian Annual Report, 1900, p. 551.

In weighing the fulcrum was shifted from place to place, and there were notches for the suspending cord, determined, no doubt, with known weights, these having been calibrated with the balance. This Danish steelyard, desemer or bismar had, then, a graduated beam whose graduations followed no observable law and were wholly empirical. It is this that Aristotle discusses in his "Mechanical Problems," though without much success.

The Roman steelyard, "Statera Romana," familiar in modern form and but little improved since classical antiquity, appeared first perhaps in Egypt, perhaps in Campania. I can only quote authorities.

F. Müller:[4]

B.C. 1350. The steelyard with running weight is in use among the Egyptians.

L. Darmstaedter:[5]

B.C. 1400. The steelyard with running weight is in use at the time of the Egyptian king Amenophis IV.

F. M. Feldhaus:[6]

Unequal armed balance with running weight, usually called Roman steelyard. This balance has a short arm, on which the weighing pan hangs, and a long arm, bearing a graduation and notches for suspending a running weight. The steelyard is known to have been in use in Egypt about B.C. 1400.

Against these very definite statements must be set the authority of Sir J. G. Wilkinson[7] and of Dr. L. W. King and Flinders Petrie,[8] and of all others, as far as I know, who have published on the subject or answered my inquiries about it, to the effect that the Egyptians did not have the steelyard till the Roman period. Harper's "Book of Facts" (1905) says that it is mentioned B.C. 315—I do not know by whom.

Incidentally, I may say that I was not a little surprised to find this contradiction, and that so well known an instrument of trade should have so uncertain an origin.

I will assume that the Roman steelyard dates back to B.C. 400, and was then known through Mediterranean civilization. He who first graduated it may be called the true discoverer of the law of moment equilibrium, the law of the lever. With any pry or crowbar, or with the bismar, one would have to search for the law deliberately; but this improved weighing apparatus made for trade purposes displays its law to the eye. I imagine the inventor as using a bismar beam, but keeping the fulcrum fixed and sliding along a rider weight, calibrating the beam by means of known balance weights in the pan. The unaided eye could see that equal added weights in the pan corresponded to equal increments of length on the graduation; and so we may understand how Aristotle (B.C. 384–322), long before Archimedes (B.C. 287–212), was able to state the law thus"[9] . . . as the weight moved is to the weight moving it, so, inversely, is the length of the arm bearing the weight to the length of the arm nearer the power. . . ." This he attempts to demonstrate as a consequence of the properties of the circle, but with poor success.

Archimedes, knowing this law of the lever, wrote a book on the subject, unfortunately lost. Another book of his has come down to us, in which he discusses the subject of balanced bodies and the location of centers of gravity in certain plane figures. He does not define center of gravity, but from the use he makes of the term in his demonstrations it is clear that he means by it the point where a body balances when there suspended. This point he treats as representative of the body, and assuming this he attempts a demonstration of the law of the straight horizontal lever, or law of moment equilibrium. E. Mach[10] points out, however, that this demonstration, superficially convincing, is seen to be fallacious

[4] "Zeittafeln zur Geschichte der Mathematik," etc., p. 3 (1892).

[5] "Handbuch zur Geschichte der Naturwissenschaften," etc., p. 3 (1908).

[6] "Die Technik," p. 1251 (1914).

[7] "Manners and Customs of the Ancient Egyptians" (1878).

[8] Quoted by H. L. Roth, *l. c.*

[9] "Questiones Mechanicæ," E. S. Forster, trans. (1913).

[10] Science of Mechanics," McCormack trans., p. 18 (1902).

when one attempts to define more closely the concept *center of gravity*. For the law of the lever then appears as implicitly assumed in this concept, and hence not to be demonstrated by its use.

Our knowledge of Archimedes's attainments is limited to the scanty remnants which generations of militarists have allowed to survive. An examination of Aristotle's "Mechanical Problems" shows that even before Archimedes certain phenomena of the simplest machines were puzzling, that the effort-demanding quality of bodies presented itself in two aspects. Aristotle says (Ch. 10):

> Why is it that a balance moves more easily without a weight upon it than with one? So too with a wheel or anything of that nature, the smaller and lighter is easier to move than the heavier and larger. Is it because that which is heavy is difficult to move not only vertically but also horizontally? For one can move a weight with difficulty contrary to its inclination, but easily in the direction of its inclination; and it does not incline in a horizontal direction.

Again (Ch. 19):

> How is it that, if you place a heavy axe on a piece of wood and put a heavy weight on the top of it, it does not cleave the wood to any considerable extent; whereas, if you lift the axe and strike the wood with it, it does split it, although the axe when it strikes the blow has much less weight upon it than when it is placed on the wood and pressing on it? Is it because the effect is produced entirely by movement, and that which is heavy gets more movement from its weight when it is in motion than when it is at rest? So, when it is merely pressed on the wood, it does not move with the movement derived from its weight; but when it is put into motion, it moves with the movement derived from its weight and also with that imparted by the striker. Furthermore, the axe works like a wedge; and a wedge, though small, can split large masses, because it is made up of two levers working in opposite directions.

P. Duhem,[11] comparing the methods of the two great Greeks, says:

> Admirable as a method of demonstration, the path followed by Archimedes in mechanics is not a method of invention; the certainty and the clarity of his principles stick on the whole where they are plucked, so to speak, on the surface of phenomena, and are not pulled up by the roots from the bottom of things; according to a remark which Descartes made less justly about Galileo, Archimedes "explains very well *what is* so, but not *why it is so*," therefore we shall observe the more striking forward steps in statics to start rather from the doctrine of Aristotle than from the theories of Archimedes.

But one should not look to the "Mechanical Problems" for demonstrations by an admirable method; they are but poor attempts at demonstration, from the hand of one of whom Duhem[12] writes:

> Aristotle was not a geometer; from the principle which he had set up, he did not know how to draw with entire rigor all the consequences which can be deduced from it.

Attempts at demonstration, moreover which have doubtless suffered by transcription a hundredfold repeated, and at the hands of teachers and pupils who were merely Aristotelians. Unable successfully to solve his problems, he has yet the great merit, greater than that of a mere problem-solver, of perceiving the existence of the problems, and putting forward a statement showing the difficulty.

He for whom his most famous pupil, the conquering explorer Alexander, made collections of natural history, sending them far by the slow transport of those days to his master's school of science, was no pedant of the schools. He knew the mint, the market and the quarry; he saw the balance pans easily swinging when empty, but, loaded with metal or meat and balanced, hard to set in motion; he thought it odd that balanced weights, which, so to speak, lift each the other,[13] should be hard to move; he saw the cylindrical column sections rolled with labor up inclined planes out of the quarry, but rolling down again at a touch; why should they be hard to

[11] "Les Origines de la Statique," p. 12 (1905).

[12] *Loc. cit.*, p. 8.

[13] "Q. M.," Ch. 26. "Why is it more difficult to carry a long plank of wood on the shoulder if one holds it at the end than if it is held in the middle? . . . The reason is, that if one lifts it in the middle, the two ends always lighten one another, and one side lifts the other up."

roll on a level, though then neither descending nor ascending? "Is it because that which is heavy is difficult to move not only vertically, but also horizontally?" Is it because things require an effort not only for lifting them, but also for setting them in motion?

He is evidently groping; his difficulty is, that he fails to analyze the meaning of the phrase, *easy to move,* or, *to move easily.* A thing is easy to move when with a slight effort in a short time we change its speed considerably, or give it a large acceleration; it is hard to move when we must exert a considerable effort to produce the same total change in speed, or a slighter effort for a longer time, then giving it only a small acceleration. He has not distinguished clearly the elements *inertia,* of which *mass* is the quantitative measure, and *acceleration,* or rate of change of speed; but he does see that there is a fundamental distinction between accelerating a body in the horizontal direction, the direction in which its motion is unaffected by weight, and accelerating it in the vertical direction, when the weight hindrance is superposed on and confused with the difficulty of acceleration. His observations being merely sensuous and qualitative, he could not know by measurement the constancy of gravitational acceleration, nor could he escape from the confusion of weight and mass which this same constancy made inevitable.

Again, watching the woodman and his axe, Aristotle knew that effort exerted as steady pressure would not cleave the block, though when swung through the air the blade split the wood instantly. It seemed odd to him that a continuing effort without motion should be unable to achieve an end so easily reached by an effort no greater used to produce motion of the axe.

> Is it because . . . that which is heavy gets more movement from its weight when it is in motion than when it is at rest?

For *movement* read here *momentum,* or use Newton's phrase, *quantity of motion,* and read *mass* for *weight,* and the query sounds much more modern, though not yet quite clear. He was again groping after distinctions later grasped by Newton. In his observation there was, of course, nothing new; upon such the arrow-maker's craft was built millennia before Aristotle; but he was perhaps the first to record a feeling of perplexity concerning them.

In another place (Ch. 31) Aristotle asks:

> Why is it that a body which is already in motion is easier to move than one which is at rest?

This evidently deals with running and starting friction. His answer is very unsatisfactory; but this query, as do one or two others, touches on the nature of friction, that other obstacle which for ages prevented the development of a science of mechanics.

I have no doubt that these two facts in terrestrial experience, the universality of friction and the practical constancy of gravitational acceleration, were not only the chief causes of the slow development of mechanics, but are also to-day among the main reasons why so many, perhaps most, of our athletically and mechanically wise students not only fail to comprehend the laws of motion—they simply do not believe they are so. They are confirmed Animists; to imagine a force acting, they must imagine themselves acting right there, or the agent feeling as they would in its place. They do not believe in a natural tendency of things to keep on going, and acceleration is to some of them a concept of inaccessible refinement. "To describe the motions which occur in nature, in the simplest way," or otherwise than in terms of their own effort sensations is a problem of small interest. And with the phenomena thus sensuously described, to them a body is hard to throw *because* it is heavy. From qualitative experiences, such as their predecessors since and before the Stagyrite have had in fulness, they will never gain conviction of the truth. Experiments must be devised and set before them to induce in them the perplexity Aristotle felt in presence of the loaded balance and the rolling cylinder; for this feeling of perplexity, and a revolt against it, are the beginning of science; then they must resolve this perplexity by experiments and study which will lead them

along the path of Leonardo, Kepler, Galileo, Huygens and Newton.

WILLARD J. FISHER
WORCESTER POLYTECHNIC INSTITUTE,

THE SCIENTIFIC MEMBERS OF THE BRITISH EDUCATIONAL MISSION

As has been noted in SCIENCE, the British government, on the invitation of the Council of National Defense, has sent to the United States a distinguished mission to inquire into the best means of procuring closer cooperation between British and American educational institutions, to the end, greatly desired on both sides, of making increasingly firm the bonds of sympathy and understanding that now unite the English-speaking world.

The members of the mission are:

Dr. Arthur Everett Shipley, vice-chancellor of the University of Cambridge, master of Christ's College and reader in zoology.

Sir Henry Miers, vice-chancellor of the University of Manchester and professor of crystallography.

The Rev. Edward Mewburn Walker, fellow, senior tutor and librarian of Queen's College, member of the Hebdomadal Council, Oxford University.

Sir Henry Jones, professor of moral philosophy, University of Glasgow.

Dr. John Joly, professor of geology and mineralogy, Trinity College, Dublin.

Miss Caroline Spurgeon, professor of English literature, Bedford College, University of London.

Miss Rose Sidgwick, lecturer on ancient history, University of Birmingham.

The proposed itinerary of the mission follows:

October	8–14—New York.
"	15–17—Washington (Mt. Vernon).
"	18—Baltimore.
"	19–21—Philadelphia (Bryn Mawr, Haverford).
"	22–23—Princeton.
"	24—New York (Vassar).
"	25–26—New Haven.
"	27—Amherst, Smith, Mt. Holyoke.
"	28–30—Boston and Cambridge (Wellesley).
"	31–
November	2—Montreal (Ottawa).
"	3– 5—Toronto (Niagara Falls).
"	6—Ann Arbor.
"	7–12—Chicago (Urbana, Evanston).
"	13–14—Madison.
"	15–17—Minneapolis and St. Paul.
"	18—Des Moines (Ames).
"	19–20—St. Louis.
"	21—Cincinnati.
"	22—Lexington, Ky.
"	23—(Louisville).
"	24—Nashville.
"	25–28—New Orleans (Houston, Austin).
"	29–30—Tuskegee.
"	31—Chapel Hill.
December	1—Charlottesville.
"	2—Washington.
"	4– 7—Boston and Cambridge.

The British Bureau of Information has prepared a statement concerning the members of the mission, and we give the biographical sketches of the scientific members.

DR. ARTHUR EVERETT SHIPLEY

Arthur Everett Shipley, Sc.D., vice-chancellor of the University of Cambridge, is well known in the United States, in which he has on several occasions been an honored guest. He is an honorary D.Sc. of Princeton University, foreign member of the American Association of Economic Entomologists and of the Helminthological Society of Washington. Dr. Shipley is a member of the Central Medical War Committee of Great Britain. He holds many offices of great responsibility, being, for example, a trustee of the great collection of specimens illustrative of many branches of science which was made by John Hunter, purchased by the government after his death in 1793, and presented to the Royal College of Surgeons; a trustee of the Tancred Foundation established by Christopher Tancred (1689–1754) of Whixley Hall in the County of York, to provide studentships in divinity and in physic; a trustee of the Beit Memorial Fund for fellowships for medical research; chairman of the Council of the Marine Biological Association; vice-president of the Linnæan Society; member of the Royal Commission on the Civil Service. In 1887 he was sent to the Bermudas by the Colonial Office to investigate a plant disease. He was also commissioned by the

British government to investigate grouse disease, and the volume on "Grouse in Health and Disease" which he published records many observations regarding the pathology of birds. He is a fellow of the Royal Society.

Dr. Shipley's writings on many branches of zoology and other subjects, historical, architectural and biographical, are too numerous for mention. They include several standard textbooks of zoology. The study of parasitical animals is his especial hobby. Since the commencement of the war he has written two books of extraordinary interest and humor, on a subject which, if less skilfully handled, would be generally regarded as repulsive—lice, bugs, fleas and flies—little animals which in all former wars have contributed to the failure of armies in almost as large a measure as swords or guns. But for recent knowledge of their habits the havoc which they have worked in this war, already sufficiently serious, might have been the determining factor. "The Minor Horrors of War" and "More Minor Horrors" are books which may be read with pleasure by the least scientifically inclined of men and women.

As master of Christ's College, Dr. Shipley inhabits a "lodge" which the foundress, the Lady Margaret, mother of Henry VII., once occupied. The lodge, like all similar houses, had been altered to suit the taste of each succeeding age. The new master immediately after his election devoted much money and antiquarian knowledge to its restoration to something like its original condition. Soon after the commencement of the war he turned the house into a convalescent home for wounded officers, several hundreds of whom have since lived with him. In other forms of war work he has also been very active, especially in the collection of clothes for Belgian refugees, and the maintenance and education of Serbian boys, for which the members of the university, with great generosity, made themselves responsible.

SIR HENRY MIERS

Sir Henry Miers was born in South America, where his father was an engineer (as his grandfather had been before him), but was brought to England at the age of two. One of his great-grandfathers was Francis Place, the self-educated politician who was a leader in the reforms of 1824–1841.

He was educated at a private school near Oxford, where among his schoolfellows were the late Lord Parker, of Waddington, and George Macmillan, whose firm is well known in the United States. Thence he went with a scholarship to Eton, and was there for five years. The course at Eton was almost purely classical, but Miers did a considerable amount of science and mathematics out of hours, winning school prizes in these subjects among others. He also won the gold medal in geography offered at that time by the geographical society for competition among public schools; among the honorably mentioned on that occasion was his schoolfellow Cecil Spring-Rice, afterwards ambassador to the United States. Lord Curzon was also one of his exact contemporaries at Eton.

In 1877 he went with a classical scholarship to Trinity College, Oxford, and read double (classics and mathematics) for the first degree examination, and double (mathematics and physics) for the final examination. But he left Oxford before the final examination in the science school in order to prepare for a position which was about to be established in the mineral department of the British Museum. His interest in mineralogy had been stimulated at Oxford by Professor Story-Maskelyne, whose lectures he attended. The professor was then a member of parliament, and came up from London to lecture to Miers, who was for a time his only pupil. He also worked at the subject in the long vacation at Cambridge and in other vacations at the British Museum.

At the British Museum he was a first-class assistant for twelve years, and during that period published about fifty scientific papers. His teaching experience also began in London, for he was invited by Professor Armstrong to start the teaching of crystallography at the neighboring Central Technical College (which has now been absorbed in the Imperial College of Science and Technology). This continued for about nine years, when he was succeeded

by one of his first pupils, W. J. Pope, who is now professor of chemistry at Cambridge.

One of his adventures during the period of his assistantship at the British Museum was an attempt (in 1888) to make a balloon voyage to Vienna in company with Simmons, a well-known aeronaut, and a gentleman named Field. On approaching the coast of Essex it was thought prudent to descend, as the wind was in a too-northerly direction. The balloon, which was a very large one, was safely anchored to a tree. and the occupants of the car fell about sixty feet. Simmons was killed and Field had both legs broken. Miers, although severely bruised, sustained no permanent injury.

In 1895 a letter which he wrote to Sir William Ramsay, immediately after the meeting of the Royal Society at which Ramsay and Rayleigh announced the discovery of argon, advising him to examine the mineral cleveite for compounds of argon, led to the unexpected discovery of helium.

In the same year Miers gave some lectures for Story-Maskelyne at Oxford, and in 1896 succeeded him, on his retirement as Waynflete professor of mineralogy, becoming thereby a fellow of Magdalen College, where he lived for the next twelve years.

At Oxford he created a department of mineralogy, developed a small school of research, and published a number of papers of which the more important (mostly in conjunction with Miss F. Isaac) related to spontaneous crystallization. Among his other pupils were Dr. Herbert Smith, of the British Museum, Dr. H. L. Bowman, who succeeded him as professor, Mr. T. V. Barker, now university lecturer in crystallography, the Earl of Berkeley and his scientific colleague, Mr. E. G. Hartley. In 1902 he published a text-book on mineralogy which has been much used in the United States.

He took a considerable share in the administration of the university, and was a member of the Hebdomadal Council and a delegate of the University Press. In 1902 he succeded the late Sir E. B. Tylor, the anthropologist, as secretary of the University Museum, becoming thus responsible for its administration.

In 1908 he became principal of the University of London, in succession to the late Sir Arthur Rücker. During the greater part of his period of office the Royal Commission on University Education in London was taking evidence, and its report, recommending a large scheme of reconstitution, was only published in 1913.

Among the many activities of the university he associated himself especially with the tutorial classes for working people, with whom his ready speech and never-failing humor made him exceedingly popular. His lectures at the Working Men's College, which was founded some seventy years ago by Maurice, Tom Hughes (the author of "Tom Brown's Schooldays") Furnivall and Westlake, were events to be remembered. He also tried to gather up the scattered units of the very complicated University of London, such, for example, as the College of Household and Social Science for Women, the Officers Training Corps, and the University Club.

He assisted Mr. Albert Kahn to establish his British Traveling Fellowships, and instituted a board of trustees, of which he became a member and secretary, consisting of the Lord Chancellor, the speaker, the Lord Chief Justice with Lords Curzon and Milner as coopted members. Most of the American Kahn Traveling Fellows visited him in London at the commencement of their journey.

He was mainly instrumental in bringing about the Congress of the Universities of the British Empire, which met in 1912, and was to have met again in five years. This was prevented by the war, but the universities bureau has come into existence as the result of the Congress and will organize the next Congress when the opportunity arises.

In 1915 it was clear that the war would prevent any immediate reoganization of the University of London, and Miers therefore accepted the invitation of the University of Manchester to become its vice-chancellor. In Manchester he is already associated with many educational and civic activities outside the university; he is chairman of the Joint Matric-

ulation Board, which determines the admission of students to the five northern universities and examines and inspects secondary schools in their areas of influence; also of the Manchester Royal College of Music, of the Manchester Royal Institution, and of the newly formed northern branch of the National Library for the Blind.

He has been for many years a fellow and governor of Eton College, and fellow of Magdalen College, Oxford; was elected a fellow of the Royal Society in 1896; has been president of the Mineralogical Society, and of the Geological and Educational Sections of the British Association; is an honorary doctor of the universities of Sheffield and Christiania; was knighted in 1912; was a member of the treasury committee which reported on the reform of the Civil Service Class I examinations; and is a member of the committee appointed by the prime minister to report on adult education.

During and since college days he has devoted most of his vacation to foreign travel. In 1892, while assistant at the British Museum, he visited and reported on the public and private mineral collections of Norway, Sweden and Russia and part of Germany.

In 1901 he joined Professor Coleman of Toronto in Canada for a journey of exploration in the northern Rockies, but at the invitation of the Canadian Minister of the Interior changed his plans and visited and reported on the gold mines of Klondike, in company with Professor Coleman. He had previously visited Canada and the Pacific coast with the British Association (spending some weeks also in the United States) in 1897; and was there again with the International Geological Congress in 1913.

He visited a great part of South Africa on the invitation of the Rhodes trustees and the Johannesburg Council of Education in 1903, and was personally concerned in the first appointments made in the Transvaal Technical Institute which afterwards became the Transvaal University College. A second visit to South Africa with the British Association took place in 1905.

Many of his European journeys have been made to places which possess public or private collections of antique sculpture, in which he is interested.

DR. JOHN JOLY

John Joly, M.A., B.A., Engineering, D.Sc., has been professor of geology and mineralogy in the University of Dublin for the past twenty years. He was born in Ireland in 1857 and educated at Trinity College, in which he held various subordinate posts before his appointment to the chair which he now occupies.

For more than thirty years he has carried on research in physics, and especially in the application of physics to engineering, but his exceedingly ingenious mind has led him down many by-paths in search of the solution of problems of general interest.

One of his earliest inventions was the steam calorimeter, by means of which he succeeded in determining directly the specific heats of gases at constant volume. This was a problem in experimental science which had long baffled physicists. Having invented the calorimeter, Joly turned it to excellent account in the examination of a variety of gases over a wide range of pressure and temperature.

Distinguished as a physicist, he is more widely known as a pioneer in the modern method of photography in colors. He was the first in 1897 to take successful photographs in natural colors by the use of a minutely-subdivided screen carrying the three primary colors. On a plate exposed behind this screen he obtained, in effect, three negatives on the same plate. A transparency made from this plate, when placed in an optical lantern behind a screen similarly ruled in red, green and blue lines, displayed the objects photographed in their natural colors. This experiment led, ten years later, to the development of the well-known and very efficient Lumière process on which colored starch grains are substituted for Joly's colored lines.

The ascent of sap in trees is another subject which has occupied his attention, in conjunction with Henry H. Dixon, the professor of botany of Trinity College. He offered a simple

explanation of this phenomenon. The theory then put forward attributes the ascent of the sap to transpiration from leaves of the tree and the tensile strength or cohesion of the fluid in its capillary tubes.

Another matter of very great general interest was dealt with by Joly when he determined the age of the ocean by estimating the amount of common salt carried to it by the rivers and calculating the length of time that must have elapsed in order that the salt in sea water should have acquired its present concentration.

Sections of various kinds of rock show remarkable little rainbow-colored circles. Joly was the first to prove that these rainbow-like circles or pleo-chroic haloes occur about particles of salts of the rare metals uranium and thorium; metals which are always undergoing decomposition into elements of lower atomic weight. The haloes are due to the bombardment of the substance of the rock by the radio-active particles discharged from the heavy elements. The rate of transformation of uranium and thorium into these radio-active substances being known, it has been possible to calculate the length of time necessary for the formation of the haloes and therefore the age of the rocks.

Joly has been a pioneer in the applications of radio-activity to geological phenomena, *e. g.*, the origin of mountain ranges.

The late Professor Lowell's book on Mars led Jolly to offer a relatively simple explanation of the canals of Schiaparelli. He attributed them to the gravitational effects of small satellites falling into the planet.

Even biological problems have engaged the versatile professor's attention. In a book entitled "The Abundance of Life" he submits a dynamic basis for evolution.

His interest in radio-activity led him at an early date to suggest the insertion of radium into cancers, and recently—in conjunction with Captain William Stevenson, R.A.M.C.—he suggested the use of emanation needles, which he invented, for therapeutic purposes.

Joly has for many years been a keen yachtsman, and recently has devoted much time to problems connected with submarine warfare. He has suggested many applications of modern science to navigation, and especially those dependent upon the principles of synchronous signalling.

In his own university Professor Joly is known as a reformer, being largely responsible for various recent changes. He became secretary to the Academic Council on the death of Professor Edward Dowden, the Shakespearean scholar.

During the rebellion in 1915 he took an active part in the defense of the college. An account from his pen of this episode appeared in *Blackwood's Magazine*. He is a commissioner of Irish Lights. He is warden of the Alexandra College for Women. For many years he has been secretary of the Royal Dublin Society. He is a fellow of the Royal Society. In 1910 he received from the society a royal medal. In 1911 he received a royal medal from the Royal Dublin Society.

Among his many publications are to be noted —"Radio-activity and Geology," "Synchronous Signalling in Navigation," "The Birthtime of the World," and a vast number of contributions to various scientific journals, notably to the *Philosophical Magazine*, of which he has been one of the editors for many years.

WILLIAM JOHN KEEP

WILLIAM JOHN KEEP, consulting engineer for the Michigan Stove Company, manufacturer of testing machines and writer on foundry topics, died on September 30. He was born in 1842, at Oberlin, Ohio, and studied at Oberlin and at Union College, where he was graduated in 1865 with the degree of civil engineer. For several years during his residence in Troy he gave a course of lectures on the steam engine to the senior class of the Rensselaer Polytechnic Institute.

During all his life Mr. Keep was very much interested in experimental tests with cast iron and other metals. In 1885 he discovered the relation between the shrinkage and chemical composition of cast iron and devised the systems of "Keep's Test," which he later named "Mechanical Analysis." This is used largely in the United States and other countries instead of chemical analysis. His

method was devised as the result of many thousands of tests described in numerous papers on the influence of silicon, phosphorus, sulphur and manganese on cast iron, on shrinkage, strength and impact of cast iron, "Keep's Cooling Curves," aluminum, etc.

His most important publication is his book "Cast Iron" (John Wiley and Sons, 1902). He was also author of a large number of scientific papers, most of which are printed in the transactions of the different organizations to which he belonged. At the time of his death he had just finished a paper "Static and Dynamic Tests with Transverse Test Bars," which gives a description of his later experiments and which will be published. Mr. Keep patented many of his devices, one of the most important of which is a system of matchplates for foundry use. His testing machines are well known, also his apparatus for "Mechanical Analysis." He was a member of the American Society of Mechanical Engineers, (vice-pres. 1903–5), American Institute of Mining Engineers, Iron and Steel Institute of Great Britain, International Association for Testing Materials, American Foundrymens Association, Franklin Institute, Detroit Engineering Society (past pres.), fellow of the American Association for the Advancement of Science, honorary member of the Rensselaer Society of Engineers and of the Foundrymen's Association of Philadelphia.

SCIENTIFIC EVENTS

SCIENCE AND INDUSTRY IN TASMANIA

Mr. W. H. Twelvetrees, government geologist in Tasmania, reports to the British Science Guild that the Tasmanian State Committee of Science and Industry has started the discussion of several subjects which can be usefully considered at the present juncture. Small working committees have been formed to deal with the questions of fuel, alcohol, improvement of seeds, tuberculosis in stock, utilization of kelp and Irish blight.

The committee has drawn up a scheme in regard to the study of problems connected with the realization of forest products. The scientific subjects for investigation are particularized as:

1. The production of wood pulp, cellulose, etc., by the disintegration of the main body of the timber.
2. The production of volatile and essential oils by the distillation of the leaves and twigs.
3. The production of a potash fertilizer from the ash obtained from the burning of the leaves and twigs.
4. The production of dyes, tannins, etc., from the various parts of the wood and possibly from the leaves.
5. The production of various distillation products from the waste timber and the conversion of same into higher priced materials for which markets could be found in different parts of the world.
6. The production of building materials from the sawdust and wood after breaking down into pulp; probably after chemical treatment for the removal of various soluble organic materials in the wood, such as lignin, hemicellulose, etc.

The state committee, without neglecting other subjects, has decided to specialize for the present on the forest industry generally. Its investigations are expected to indicate where and how the large timber areas in Tasmania can be improved, and profitable industries initiated. The committee has urged the Commonwealth Advisory Council to call delegates of the various state committees together so as to coordinate the work of carrying out a general scheme, but the council being only a provisional institution is of opinion that general research on forest products had better wait till a forest products laboratory is established under the permanent institute. In the meantime, specific research will be supported by grants-in-aid.

The production of electrolytic zinc by means of current supplied by the state hydro-electric installation is proceeding satisfactorily at Risdon, near Hobart. The chairman of the company announces that the establishment of this industry in Tasmania has been owing to a desire to prove the application of the electrolytic process to Australian ores and concentrates for the production of munition zinc,

hitherto produced within the empire in only small quantities, thus helping to make the empire self-contained as regards most important items for defence and commerce. The small plant which has been started has been putting out regularly 600 pounds of zinc per day for the last eight or nine months: and now a new 10-ton plant has been installed, permitting a production of 15 tons daily. The ultimate size of the plant at Risdon for the production of zinc is expected to have ten times the capacity of the present unit. It is also hoped to turn attention by and by to other industries made possible by the government hydro-electric undertaking. The success of the enterprise at Risdon will, it is confidently anticipated, favorably affect the zinc industry of the empire.

MANGANIFEROUS ORE IN OREGON

DEPOSITS of manganese and manganiferous ores in many parts of the United States have been examined during the last two years by geologists of the United States Geological Survey, Department of the Interior. This is essential work, because the limitation of shipping facilities has reduced the imports of manganese ore from other sources than the West Indies and Central America in 1918 nearly one third below those of 1917 and there is a prospect that they will be still further reduced in 1919. The importation of the iron-manganese alloy ferromanganese has decreased in much greater proportion and probably will soon be stopped altogether. To offset these decreases in the supply of manganese the Geological Survey has assisted in stimulating the domestic and the near-by foreign production by examining the manganese deposits in this country and in the West Indies with the view of determining the availability of the ore. The producers of domestic manganese ore have responded actively to the call made on them and have increased their production from 27,000 tons in 1916 to 116,000 tons in 1917. It now appears that the production of ore in 1918 will be 185,000 tons.

Manganese is used in various ways. Metallic manganese in the form of ferromanganese is alloyed with steel to make manganese steel and manganese dioxide is used in the manufacture of dry batteries, in glassmaking and in the chemical industries. Manganese, however, is used principally in making all Bessemer and open-hearth steels, in which it is incorporated in the form of iron-manganese alloys, which will serve as deoxidizers and purifiers of the molten metal. More than 95 per cent. of all the manganese consumed in this country is used for this purpose.

An examination of several manganiferous deposits in Oregon, including a reconnaissance of 150 square miles near Lake Creek, Oregon, was made in July, 1918, by J. T. Pardee, a geologist of the United States Geological Survey, Department of the Interior, in company with Henry M. Parks, Director of the Oregon Bureau of Mines and Geology. Mr. Parks has kindly placed at the disposal of Mr. Pardee the results of his previous work in this area, and Messrs. Parks and Pardee are jointly responsible for the estimates and conclusions here given.

So far as known the manganiferous deposits of the Lake Creek district are confined within an area of about 150 square miles in the east-central part of Jackson county, Oregon. The area is rather sparsely settled, and farming is the principal industry. The nearest large town is Medford, which is 15 miles directly southwest of the deposits but nearly twice that distance by the available roads. Eagle Point, a town on the Pacific & Eastern Railway, is the most convenient shipping point. The surface of the region is hilly and in places mountainous, but only moderately rugged. The local relief ranges from a few hundred feet to 2,000 feet or more, and the general elevation is between 2,000 and 2,500 feet. Streams are numerous, though most of the smaller ones become dry in summer. The climate is mild and the year is made up of a wet and dry season, corresponding to winter and summer. Most of the rather heavy winter precipitation falls as rain. The greater part of the surface that lies below 2,500 feet is covered with a mixed growth of madrona, manzanilla, and chapparal bushes and rather

scrubby oaks. At higher elevations fir and pine tres are abundant.

The area is underlain by igneous rocks that appear to be chiefly basaltic and andesitic flows and tuffs. The sequence of the rocks in part in the Lake Creek district comprises, beginning with the lowest flow, a platy basalt, 500 feet or more thick; a red basalt tuff, commonly manganiferous, 100 to 300 feet or more thick; a platy basalt, a few feet to 100 or more feet thick; dark gray to buff,locally manganiferous, andesitic tuffs and breccias, a few feet to 500 feet thick; vesicular to compact massive gray and purplish gray andesitic flows and tuffs, about 500 feet thick; and dense black basalt that weathers light gray on the surface, a few feet to more than 100 feet thick.

About 1,500 tons of ore, containing at least 15 per cent. of manganese, is "in sight." In addition, incomplete prospecting by drilling and by open cuts indicates that at least 4 acres are probably underlain by 10 feet of ore (about 120,000 tons) containing probably 10 per cent. of manganese. The surface indications in other parts of the district warrant an estimate that they may yield 130,000 tons more of material carrying at least 10 per cent. of manganese, so that the probable reserves of ore of this grade amount to at least 250,000 tons.

EXHIBIT OF MINERALS USEFUL IN WAR

Graphically displayed in the Hall of Minerals of the American Museum of Natural History is a series of minerals intended to visualize the steps necessary in the development of war munitions from the crude ore to the finished product, and to point the urgent need of domestic production. Included in the exhibit are the rarer minerals such as mercury, nickel, manganese, chromium, tungsten, vanadium and molybdenum, and under each specimen of these a label indicating in what particular industry it is used. For instance we find molybdenum steel is used in the construction of the inner tubes of large guns, as it has been found that this metal best resists the erosion caused by the gases developed by smokeless powder.

There are also displayed small distribution maps showing the occurrence of the ores in the United States and other countries, giving locations of the principal supplies prior to the war, and indicating regions in this country worthy of development. Particularly interesting is the display of finished products. Through the courtesy of a number of prominent manufacturers, material has been secured which illustrates how these minerals and metals are extracted and are being turned into tools for our army forces. By this means one can trace the application of mercury from cinnabar—how the primers are charged with fulminate of mercury which explodes the hand and rifle grenades now being so successfully used in pushing back the Teuton forces. One may also see a sectional barrel of the three-inch naval gun with its lining of molybdenum steel. Also interesting and instructive is the series showing the many stages required in the manufacture of a completed nickel-jacketed bullet like those now being used by thousands in our rifles, machine guns and revolvers.

Stamped on the lead insert of the .303 caliber cartridge used in the Lee-Enfield rifle of the British Army, are the letters "U. S.," which must have served as a reminder to the Kaiser's troops, in the early part of the war, that these particular arguments were made in the United States. Another display makes comparison of these modern messengers of death with those in use during our Civil War.

LIBRARY OF THE EDGEWOOD ARSENAL LABORATORY

Major Wm. Lloyd Evans, Chemical Warfare Service, has addressed the following letter to Colonel Wm. H. Walker, commanding officer:

As we are becoming more settled in our laboratory work, the need for the well-known handbooks and chemical journals becomes more apparent daily. We are badly in need of such works as Beilstein's *Organische Chemie*, Landolt-Börnstein, *Tabellen*, *Journal of the American Chemical Society*, *Journal of Industrial and Engineering Chemistry*, *Metallurgical and Chemical Engineering*, *Journal of the Society of Chemical Industry*, *Transactions*

of the American Society of Testing Materials, Transactions of the American Electrochemical Society, and many others that readily suggest themselves. Through the kindness of the duPont Company, of Wilmington, we have been able to locate the owners of a few of these desirable works, but as you can readily imagine they are very difficult to obtain. You will be happy to know that Dr. Ira Remsen has offered us his *Gmelin-Kraut* as a loan.

It has occurred to me that a notice placed in the *Journal of Industrial and Engineering Chemistry* and also in SCIENCE, explaining the needs of this laboratory, might bring forth loans of books we greatly desire. If the commanding officer, Edgewood Arsenal, concurs in this view, might I respectfully suggest that this notice be asked for, and that all communications in reference to the same be made to the commanding officer, Edgewood Arsenal?

Colonel Walker has approved the suggestion and has authorized the publication of the letter. He will be glad to receive books loaned to the laboratory and to return them without damage at the end of the war. In case of damage or loss involving any or all of the books the Edgewood Arsenal assumes liability up to 150 per cent. of the original price. The cost of packing and shipping the books to and from Edgewood Arsenal will be borne by the government.

ENDOWMENT FOR ENGINEERING RESEARCH

AT a joint meeting of the trustees of the United Engineering Society with the Engineering Foundation Board in New York on October 7 announcement was made that Ambrose Swasey of Cleveland, Ohio, had given the Engineering Foundation an additional $100,000 for endowment of engineering research.

Mr. Swasey, who is a past-president of the American Society of Mechanical Engineers, is well known as a designer and builder of large telescopes and other optical instruments and fine machine tools. In 1915 he gave $200,000 for engineering research, so that the total endowment is now $300,000. Mr. Swasey's original gift made possible the establishment of the Engineering Foundation by the United Engineering Society, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. His gifts have been inspired by his conviction of the necessity for research in engineering science not only in connection with the war but for keeping the United States in the forefront of nations in industrial development. This latest gift is an expression of Mr. Swasey's appreciation of the war service which the United Engineering Society and the Engineering Foundation have rendered to the country.

SCIENTIFIC NOTES AND NEWS

DR. VERANUS A. MOORE, head of the New York State Veterinary College at Cornell University, was elected president of the American Veterinary Medical Association at the annual meeting held recently in Philadelphia.

DR. A. E. KENNELLY, of Harvard University and the Massachusetts Institute of Technology, has recently returned from a trip overseas during the summer on special duty for the United States Army Signal Corps.

LIEUTENANT COLONEL WILLIAM H. WELCH, of the Johns Hopkins Medical School, now attached to the surgeon-general's staff at Washington, is recovering from an attack of influenza.

LIEUTENANT COLONEL THOMAS R. BOGGS, Baltimore, has been made chief medical consultant for the air service of the American Expeditionary Forces, attached to general headquarters.

CAPTAIN MADISON BENTLEY is now president of the Aviation Examining Board, examining aviation recruits from New England colleges.

CHARLES F. BROOKS has received leave of absence from Yale University where he was instructor in geography, in order to become an instructor in meteorology in the Signal Service.

MAJOR GENERAL WILLIAM C. GORGAS, who has now returned from his inspection trip to France, has received from Secretary Baker a letter, which has been made a part of his military record, expressing the appreciation

of the nation for his distinguished services during a long career as a medical officer of the army. General Gorgas, formerly surgeon general, was recalled to the active list when he reached the retirement age while in France. His first task will be to prepare a report on the care of sick and wounded American soldiers in France.

It is planned that scientific information regarding the influenza epidemic now daily accumulating in the New York State Department of Health and elsewhere shall be correlated and made available to health officials and the medical profession through the action of Governor Whitman, who on October 22 appointed a commission to study and report on the cause, prevention and treatment of the disease. Among those who have been invited to serve on this commission are the surgeon generals of the United States Army, Navy and Public Health Service, Dr. Rufus Cole; Dr. Walter B. James, president of the Academy of Medicine, New York City; Dr. Hermann M. Biggs, New York state commissioner of health, and Professor William H. Park, director of the Research Laboratories, New York City Department of Health.

For the purpose of coordinating the policies of the War Department and the Navy Department in patent matters the secretary of war and the secretary of the navy have established the Munitions Patent Board. The membership consists of Thomas Ewing, who has been jointly selected by the secretary of war and the secretary of the navy, Max Thelen, representative of the War Department, and Pickens Neagle, representing the Navy Department.

Dean Albert R. Mann, of the College of Agriculture of Cornell University, has been appointed by Governor Whitman a member of the State Food Commission, filling the vacancy created by the resignation of President Schurman on his departure for Europe. By virtue of this appointment Dean Mann becomes also a representative of the state of New York on the Federal Food Board.

Professor George F. Atkinson, of Cornell University, returned the last of August from a trip through Florida, Georgia, South Carolina, North Carolina and Virginia, in search of fleshy fungi. He left Ithaca on September 13 for the western coast, where he will continue his search, beginning in the mountain forests near Seattle, and going through Washington, Oregon and California. If the season is favorable, he will remain through January and February.

Dr. F. M. Fernandez, editor of the *Cronica Medico-Quirurgica* of Havana, was recently awarded the Cañongo prize by the Academy of Medical, Physical and Natural Sciences for his work on the etiology and treatment of strabismus.

The thirty-sixth stated meeting of the American Ornithologists' Union will be held at the American Museum of Natural History, New York City, November 12–14.

A memorial service for the late Professor Henry Shaler Williams was held at Cornell University on October 19. President Schurman presided and made a brief address. Other speakers were Professor Herbert E. Gregory, of Yale, on Professor Williams at Yale; Professor Herman L. Fairchild, of the University of Rochester, on Professor Williams among geologists, and Professor Edward L. Nichols, of Cornell, on Professor Williams and Sigma Xi. Letters were read from Professor James F. Kemp, of Columbia University, formerly of Cornell, on Professor Williams at Cornell, and from Secretary Charles D. Walcott, of the Smithsonian Institution, on Professor Williams the investigator.

Dr. F. F. Wesbrook, president of the University of British Columbia, previously professor of pathology in the University of Minnesota, died on October 20, at the age of fifty years.

Professor William Leslie Hooper, head of the department of electrical engineering at Tufts College, died at his home in Somerville on October 3. Professor Hooper had been a member of the faculty at Tufts for thirty-five

years and was acting president in 1912 and 1913. He was born at Halifax, N. S., in 1855.

CAPTAIN GEORGE S. MATHERS, for three years a member of the staff of the McCormick Institute for Infectious Diseases, Chicago, died of pneumonia on October 5, in his thirty-first year. At the time of his death Captain Mathers was in charge of the laboratory of the base hospital at Camp Meade.

PROFESSOR JOHN FLOYD STEVENS, instructor in Cornell University from 1908 to 1913, and later assistant professor of electrical engineering in the University of North Dakota, who had recently gone to Schenectady to enter the employ of the General Electric Company died on October 1, of pneumonia.

STUART C. VINAL, M.S., assistant entomologist, Massachusetts Agricultural Experiment Station, died on September 26 at the age of twenty-three years. He discovered the presence of the European corn borer, *Pyrausta nubilalis,* in this country last year and was engaged in the study of its habits when seized with influenza.

THE death is noted in *The Auk* at the age of eighty-four years of Professor Jonathan Young Stanton, who occupied the chair of Greek and Latin in Bates College from 1863 until his retirement as professor emeritus in 1906. Professor Stanton took a deep interest in the study of ornithology. For many years he conducted classes in this subject both in the lecture room and in the field, and after his retirement in 1906 until about a year before his death continued to give lectures and conduct field classes.

The Auk also announces the death of Colonel William Vincent Legge, a corresponding fellow of the American Ornithologists' Union, in Tasmania in his seventy-fifth year. Colonel Legge's chief interests outside of his profession were forestry, physiography and ornithology. He was one of the founders of the Royal Australasian Ornithologists' Union and its first president. During his nine years service in Ceylon he gathered the materials for his most important ornithological work, "The Birds of Ceylon" in two volumes, quarto, with colored plates, which he published during a subsequent staff appointment in England. Among his other ornithological publications is his "Systematic List of Tasmanian Birds."

A BILL is under consideration in Congress for an appropriation of $250,000 to build an addition to the Hygiene Laboratory of the Public Health Service in Washington, D. C., and in the house, a special rule has been brought in making this bill a special order.

OWING to the depletion of its staff by the demands of the war and the difficulty of securing a sufficient number of competent assistants with the funds available, it is anticipated that the investigations with the respiration calorimeter which have been in progress at the Pennsylvania State College under the direction of Dr. H. P. Armsby since 1902 with the cooperation of the United States Department of Agriculture will have to be discontinued for the present. The investigations since 1915 have been upon the metabolism of dairy cows, with the cooperation of the Dairy Division of the department, and it is hoped that it may be possible to continue such phases of the work as do not require the use of the calorimeter.

ACCORDING to a press dispatch from Paris Dr. Alexis Carrel, of the Rockefeller Institute for Medical Research, of New York, was recently seeking a building at Saint Cloud suitable for a laboratory and workshop near certain hospital centers. He found the house he wanted in a park full of splendid trees. The "Verger" (Orchard), as the property was called, belonged to Andre Bernheim, who had refused the most tempting offers to rent it on account of the family souvenirs it contained and the art treasures. When Mr. Bernheim heard of Dr. Carrel's wish to lease his house he said "Tell Dr. Carrel that I am greatly flattered at his choice and that the Verger and its surroundings are at his service." When the question of rent was raised, Mr. Bernheim declared, "No, no, a scientist owes nothing to anybody. It is I who am honored."

DEPENDENT almost wholly upon Germany for potash at the outbreak of the war, the United States within two years will be able to manufacture enough to supply the nation's needs.

Secretary Lane made this announcement in reviewing the progress made by private concerns and the Department of the Interior in developing means or producing potash. In addition to the manufacture of potash from the brine lakes of California, Nebraska and other states, and kelp or seaweed of the Pacific coast and from various minerals, the secretary said that through processes discovered by Dr. Frederick Cottrell, chief metallurgist of the Bureau of Mines, potash is being made from smelter, blast furnace and cement plant by-products. A single large blast furnace, it is estimated, will yield from 5,000 to 7,000 tons of potash annually.

The national park on Mount Desert Island, on the Maine coast, is henceforth to be known as Lafayette National Park. Announcement to that effect has been made by Secretary Lane of the Department of the Interior. The new national park is to embrace lands once owned by France and the name conferred upon it is meant to express America's deep sympathy with France, as well as grateful appreciation of aid afforded to us by that nation in the past. Two years ago these lands were proclaimed the Sieur de Monts National Monument. They constitute the dominant and chief landscape part of Mount Desert Island. The island was discovered by Champlain and for more than a century was a part of French Arcadia.

The Scottish Geographical Magazine states that the Council of the "Touring Club Italiano" has announced its intention of producing a *Grande Atlante Internazionale*. In its general scope and conception the Atlas is to be essentially Italian, but it will also emphasize international features. Italy aims at the extension of her world commerce, and particular attention will be paid to showing the means of communication and transport in different countries. Whilst developing the best characteristics of the great atlases which it desires to emulate, it will also include various large-scale maps of the Italian colonies and those parts of Italy most frequented by tourists. The whole scheme is a considerable undertaking, but it appears to be well organized. The maps are to be issued to subscribers in sets, and each set will be complete in itself for one or more countries. It is expected that about sixteen maps will appear annually, and that it will take about eight or ten years to complete the whole work. This seems a long time, but it is hoped that progress will be expedited when the work is fairly under way. The scientific editor of the atlas is to be Professor Olinto Marinelli of Florence; the technical work of drawing and engraving will be under the supervision of Signor P. Corbellini; whilst the general direction will be controlled by Signor L. V. Bertarelli at the office of the club in Milan. The Touring Club Italiano had done excellent work in the past, and its cartographic achievements in the department of touring maps and guidebooks are worthy of high praise. We have, therefore, every reason to believe that this new and ambitious venture will justify all expectations of success.

UNIVERSITY AND EDUCATIONAL NEWS

Dr. Allan J. Smith has been appointed dean of the medical department of the University of Pennsylvania in succession to Dr. William Pepper.

Dr. E. D. Ball, state entomologist of Wisconsin, has accepted the position of chairman of the department of zoology and entomology at the Iowa State College at Ames. He will also be entomologist of the Experiment Station and state entomologist.

Dr. Joseph Peterson, assistant professor of psychology in the University of Minnesota and chairman of the department for the present academic year, has resigned to accept a professorship in psychology in George Peabody College for Teachers, Nashville, Tenn.

Dr. R. M. Winger, of the department of mathematics of the University of Oregon, has accepted a professorship in mathematics at the University of Washington.

Dr. E. L. Packard, head of the department of geology at the Agricultural College of Mississippi during the past year, has returned to

the University of Oregon as professor of geology.

GEORGE W. MUSGRAVE has resigned his position in the Bureau of Soils, United States Department of Agriculture, to become assistant professor of agronomy at Rutgers College.

DR. R. KUDO, formerly in charge of the department of protozoology of the Imperial Sericultural Experiment Station of Japan, and last year temporary assistant at the Rockefeller Institute in New York City, has been appointed instructor in zoology at the University of Illinois.

MRS. HELEN B. OWENS has been appointed instructor in mathematics at Cornell University.

JOSEPH WARREN PHELAN has been appointed lecturer on industrial chemistry at Harvard University. Harlan True Stetson has been appointed instructor in astronomy in the same institution.

DISCUSSION AND CORRESPONDENCE

THE SCIENTIFIC NAME OF THE PASSENGER PIGEON

THE technical name of the passenger pigeon has for many years been *Ectopistes migratorius* (Linnæus) (= *Columba migratoria* Linnæus, "Syst. Nat.," ed. 12, I., 1766, p. 285). There is, however, another name, *Columba canadensis* Linnæus ("Syst. Nat.," ed. 12, I., 1766, p. 284), based on the *Turtur canadensis* of Brisson ("Ornith.," I., 1760, p. 118), that needs consideration. Reference to Brisson shows conclusively that his detailed description is that of the female passenger pigeon, as he mentions particularly the rufescent tail-spots. Both *Columba canadensis* Linnæus and *Columba migratoria* Linnæus are of equal pertinence, and there seems to be no reason for the rejection of the former, since both the International and the American Ornithologists' Union codes of nomenclature provide definitely for the enforcement of the principle of anteriority (page precedence) in such cases. We should, therefore, hereafter call the passenger pigeon *Ectopistes canadensis* (Linnæus).

HARRY C. OBERHOLSER

ALLEGED REDISCOVERY OF THE PASSENGER PIGEON

STATEMENT BY JOHN M. CLARKE, DIRECTOR NEW YORK STATE MUSEUM

The enclosed letter from Mr. M. Rasmussen, of Amsterdam, N. Y., is in reply to an inquiry from me regarding a statement of his discovery which Mr. Rasmussen had left with one of my associates at the State Museum.

I have had a personal interview with Mr. Rasmussen since the date of the enclosed letter, in which he tells me that he has been a student and observer of birds for twenty-five years; that he had with him on this date, October 1, Mr. C. O. Wilson and Mr. William Sanders, of Amsterdam, both students, and that they were together for a bird study trip through the country in the vicinity of West Galway and Charlton, N. Y.

56 GLEN AVE.,
AMSTERDAM, N. Y., October, 5, 1918.

DR. JOHN M. CLARKE,
Director, State Museum,
Albany, N. Y.

Dear Sir: Answering your letter of yesterday: Yes I am absolutely sure that the birds were passenger pigeons and not the mourning dove. I could not have made this positive observation by seeing the flock, because we did not get close enough to make sure, but some were in a buckwheat field on the opposite side of the road from the field where we raised the flock, and because we knew, by seeing the flock and by the whistling sound of their wings, that we had seen wild pigeons we took precaution to get as close to them as possible. Two of us were fortunate enough to have a bird light on a low limb of a tree only a few feet in front of us, as we were standing still under cover in the edge of the woodlet, while my dog was raising the birds in the field. We were so close that we could see the orange-red skin about the eyes, and the bluish color of the back and the head with no black spot near the ear region; also the large size of the bird convinced us that we had a passenger pigeon before us, and that we had seen a small flock of them a few minutes before.

The mourning dove is not so rare a bird to me. I have seen small flocks of them from time to time during the twenty-five years I have lived in this state.

I never but once before saw wild passenger

pigeons and that was near Ithaca, about twenty years ago.

Very truly yours,

S. M. Rasmussen

DO WE WANT A GREAT PRIVATE INSTITUTION FOR INVENTORS LIKE THE INSTITUTE OF FRANCE FOR ARTISTS?

I am impressed doubtfully by a pretentious plan which I have seen for a national laboratory for invention and research. I question seriously if inventors want a great, powerful group of men in existence who can do them just as much injury as good by its hasty condemnation of their so-termed "useless" inventions as by helping them with those which certain men, chiefs of proposed bureaus, may see something in.

Let us not forget that Professor Langley and Mr. Graham Bell who backed him were both ridiculed by the three greatest pioneers of their time, Lord Kelvin, Carnegie and Newcomb. Have times really changed so amazingly since then?

Men working in laboratories like that of the Geophysical and Terrestrial Magnetic Survey are virtually research men, given a free hand and told to go ahead, as I understand it, whereas in this proposed institution the inventor is taken in as a partner so to speak in the institution and runs the danger of having his invention black-balled by some committee of the institution when a difference of opinion arises regarding his work.

We must remember further that the institution would be to inventors what the municipal lodging house is to tramps. The institution would serve in a measure as an asylum to which every man who importunes men of wealth to supply him with funds for use in his own way would be committed. If the amount of money subscribed optimistically by private individuals for the purpose of developing new inventions were concentrated in one institution, such an institution would be a colossal affair. Would not the effect of such an institution be to check the generosity of men of means towards individual inventors and make them refer the inventor to that institution just as they have by the thousand escaped their duty in fostering research by referring the importuning individual to the Rockefeller and the Carnegie Institutions?

The laobratory idea is all right as a place to work in, but let us encourage rather than discourage individual gifts to individual inventors, for no man is big enough not to have a blind side. Let there be a consulting office to which would-be investors in inventions could write and get opinions about inventions, but don't let us shut the door on the inventor by creating the municipal lodging house idea to which those with money will turn in shirking from their duty towards the inventors with whom they come in contact. With conditions as they are, we were getting out the year before the war, I understand, many more inventions than all the other nations in the world combined. Individual willingness to support inventors must be increasing rather than decreasing in America.

When I think of Langley, the Wrights, Curtiss and a host of others, I can not seem to fit them into this plan at all. Is it not true that the Institute of France, which assumed to pass upon the excellence of the work of young artists, turned down the great Rodin's work, and that it was only his supreme genius in sculpture that enabled him to live down the disgrace of its refusal to recognize him, and did he not when they wished later to acknowledge their error, refuse to allow his name to be proposed? There is a similarity between the individualist stimulus which spurs on both the inventor and the artist, and the question might now be raised as to whether a great institute for invention, similar to the Institute of France for artists, should be created, by which "a standard of merit would be placed upon any invention whatever, and its seal of approval would be equivalent to saying whether the invention was good or bad."

I wish to challenge the idea of committee estimation of inventions. There is a danger of no small proportions in it. What body of men can sit and read the volumes of claims of an unending stream of inventors and not become stale, especially if this work continues for years? What is more discouraging than the cold water of a board's decision, even though it

is as we all know who have served on committees, the opinion often of one man concurred in by others too indolent or tired or bored to look into the case thoroughly. How often the most efficient man on the committee is the astute but destructive critic who can see obstacles on every hand so clearly that he can not see the possibilities; who looking down an avenue of trees sees a wall of tree trunks and fails to realize that as you move forward there are wide open spaces between the trees.

It appears to most people a strange fact that army boards so generally turn down new and valuable inventions. General Anson Mills, for example, recounts in his autobiography how his cartridge belt (now universally used in all armies, I understand) "was submitted to every equipment board of the army organized between 1866 and 1879, but so wedded were the authorities to the use of ancestral methods that no board ever made favorable mention of my invention." This is a phenomenon traceable to the environment of committee organization and not to be explained on the ground of what is usually termed boneheadedness, and it is this environment factor which surrounds the proposed institution for invention that appears not to be appreciated by the originators of the scheme.

An institute devoted to a special field of knowledge which hires men to do research along those lines and gives them facilities and supports them is very different from one which covers practically the whole field of human knowledge and proposes to sit in judgment upon the ideas of the poor inventors.

DAVID FAIRCHILD

CIRCULAR FREQUENCY

IT would frequently be convenient if there were in common use a name for the letter n which occurs in the equation

$$y = a \cos nt$$

for simple harmonic motion. Mr. Jeans, in his "Theoretical Mechanics," p. 263, calls this n the *frequency* of the motion. This is unfortunate, because the term "frequency" is usually applied to the quantity $n/2\pi$. Professor Lamb, in his "Dynamical Theory of Sound," p. 10, suggests the term *rapidity*. I recall a few years ago seeing some place the term *Kreisfrequenz*, which suggested that we should perhaps have a satisfactory name for this n if we were to call it the *circular frequency* of the motion. This term is longer than *rapidity*, but it has an advantage in that it naturally calls to mind that the n not only is proportional to the frequency of the motion but also represents the angular velocity of an imaginary particle in the reference circle.

ARTHUR TABER JONES

SCIENTIFIC BOOKS

The Conservation of Food Energy. By HENRY PRENTISS ARMSBY. Philadelphia, W. B. Saunders Co. 1918.

This little book of sixty-five pages contains a vast amount of information concerning the relative values of different feeding substances when they are given to farm animals. The method of estimating these values is new. Armsby states "Aside from the milk requirements of the very young animal, it has been demonstrated to be entirely feasible to produce good yields of milk or well fattened carcasses, not only of cattle and sheep but of swine as well, on a ration containing ample roughage to meet the requirements for maintenance, leaving the concentrates to be applied directly to the production of human food." This is a new view point, for T. B. Wood in England[1] believes that meal made from grain is the chief kind of fodder consumed by pigs. Armsby assumes that the maintenance diet of farm animals is at the expense of coarse fodder, grass, hay, straw, etc., and that the development of food value in the animals may be ascribed to the grain ingested. The grains considered are wheat, corn, barley, rye, oats, rice and buckwheat. When these grains are fed under the above conditions, between 15 and 24 per cent. of their energy may be converted into human food in the bodies of cattle and sheep, and between 36 to 61 per cent. when they are fed to pigs and dairy cows.

[1] "The National Food Supply in Peace and War," Cambridge University Press, 1917.

However, when the grains are milled, the resulting flour used as human food and the offals given to cattle and sheep, then between 56 and 81 per cent. of the energy in the grain is recovered as food for human beings, whereas when the same offals are given to pigs and dairy cows between 60 and 85 per cent. of the energy is so recovered. It is evident that food is best conserved for man when edible grains are taken to the miller and the bran is used in meat production. Armsby shows that there is a considerable loss of energy in the food when barley is used in brewing and corn or rye in distilling. If one assumes that alcohol is without food value, then the waste is very large even though the brewers' and distillers' grains are used as fodder for pigs or dairy cows. The details given in the book are of greatest interest to those conversant with the food situation as a whole.

Graham Lusk

THE FLORA OF NORTH DAKOTA

Less than twenty years ago the first catalogue of the vascular plants of North Dakota was published.[1] Now we have a revision of the list in the form of a flora[2] which follows the plan of the well known floras of Colorado and of Washington. The introductory portion (pp. 151–174) contains a review of botanical collections in the state (3 pages), physiography of the state (6 pages), types of vegetation and their distribution (7 pages), and of plant classification with chart showing the evolution and relationship of families. The main portion contains keys to families, genera and species with citations of specimens and notes on habitat. For many species additional notes referring especially to variation of the species and its resemblance to others are given. These form one of the most valuable portions of the work. A glossary and index follow. A report by the same author on the plants of Barnes County is included in the same volume.

The arrangement of families is that of the Bessey system and the nomenclature is said to be in accordance with the Philadelphia code. A conservative stand is taken in regard to species and genera recognized. Synonyms are used freely and the reasons for reduction of segregates are stated in most cases.

Typographical errors seem to be few but one feature of the press work is particularly unfortunate. The generic and specific names in the keys are placed beyond the body of the text at the expense of the margin, especially that of the left hand side of the page. Italics are used for these names and small capitals for the generic headings, otherwise there is no distinction in type.

North Dakota is to be congratulated upon the completion of a work of as high standard as this. The simplicity of the keys, the glossary, introduction and descriptive notes will contribute much to its value to the people of the state. Notes on the flowering period would have been a valuable addition. Botanists will be especially interested on account of the geographical position of the state, situated as it is in territory not entirely covered by either eastern or Rocky Mountain manuals.

The introduction of Clement's flower chart is an excellent feature. Compared with the one in Clement's "Rocky Mountain Flowers" it seems to have been considerably improved by substituting simple symbols for the structural formulæ and especially by adding apetalous families and methods of pollination.

The writer of this review wishes to state that he has in preparation and hopes to publish shortly a paper which will bring together additional records accumulated since the close of Mr. Bergman's work with such other notes as seem worthy of inclusion.

A catalogue[3] of the plants of the state has

[1] Bolley, H. L., and Waldron, L. R., "A Preliminary List of Seed-bearing Plants of North Dakota," Bul. No. 46, N. D. Exp. Station, 1900.

[2] Bergman, Herbert F., "Flora of North Dakota," Sixth Biennial Report, Agr. College Survey of N. D., pp. 151–372, 1911–1912 (pub. September, 1918), The Bismarck *Tribune*, State Printers. The complete report of flora only may be obtained from Herbert A. Hard, Fargo, N. D. Postage 20c. Report in cloth 25c.

[3] Lunell, J., "Enumerantur Plantæ Dakotæ Septentrionalis Vasculares," *Am. Mid. Nat.*, Vol. 4–5, July, 1915–July, 1917 (reprints paged 33 to 188; first 32 blank).

been published recently. In this list citations of specimens are chiefly to the herbarium of the author which has resulted in showing a very limited distribution for a great part of the species. Some descriptive notes are given and occasionally a key to species. Among the latter is one of *Carex* contributed by Mackenzie.

Specific limits are closely drawn and subspecies are numerous. Eight new species and thirty-five subspecies are described. The nomenclature which is based upon absolute priority, is worked out with the assistance of Dr. J. A. Nieuwland, and entails changes in over 230 of the 1,246 names on the list. Fifteen new names are proposed for genera and a considerable synonymy is given.

Changes in names are unpopular with many people and narrow limitation of species yet more. But is not the "splitter" entitled to a certain measure of credit? Not infrequently do some of his discoveries become accepted, even by the conservative. Radical movements have ever resulted in notable advances in some respect. Among cultivated plants we have races of greatly different values which are scarcely separable by the smallest descriptive characters. The describer of new forms has at least brought new facts to attention of others. If variations in plants can be shown to the result of certain conditions, our knowledge has advanced. This seems to be one of the great fields for botanical investigation at the present time.

A first list of fungi[4] of the state has just been completed. This list includes nearly 900 species distributed as follows: Phycomycetes, 22; Ascomycetes, 271; Lower Basidiomycetes, 161; Higher Basidiomycetes, 119; Fungi Imperfecti 119. The completion of this notable contribution is especially fortunate since the author, formerly a physician at Kulm, N. D., is now in the military service. His work is already known through his "Fungi Dakotenses" of which eighteen fascicles of twenty-five numbers each had been issued. In the course of his work many new species have been described, chiefly by Rehm and Saccardo. These are indicated in the list by the designation "n. sp." but no reference is given to place of publication. One new species is described, *Hendersonia Cratægi.*

O. A. STEVENS
AGRICULTURAL COLLEGE, N. D.

[4] Brenckle, J. F., "North Dakota Fungi," *Mycologia*, Vol. 9, pp. 275–293, 1917; Vol. 10, pp. 199–221, 1918.

SPECIAL ARTICLES

PEAR BLIGHT WIND BORNE

WAITE[1] in 1891 proved that bees were able to transmit the bacteria of pear blight from flowers and in this way spread the disease. Of recent years several important papers have appeared which demonstrate clearly that certain other insects can act as carriers or agents of transfer. The number of insects which have now been convicted is quite large. The list includes *Adelphocoris rapidus* Say,[2] *Aphis avenæ* Fab.,[3] *Aphis pomi* De Geer,[4] *Campylomma verbasci* Mey,[2] *Empoasca mali* Le Baron,[3] *Lygus pratensis* Linn.,[5] *Orthotylus flavosparsus* Sahlberg,[2] *Plagiognathus politus* Uhler,[6] *Pæciloscytus basalis* Reuter,[2] *Scolytus rugulosus* Ratzeburg.[7]

Notwithstanding the fact that it is thus clearly demonstrated that insects can transfer this bacillus, the question yet remains as to how important they actually are in spreading this disease. While they can evidently transfer the disease are they chief or even important agents in its transfer? In order to make tests bearing on this question two pear trees about four meters high were enclosed last year in wooden frames measuring four meters square on the ground and four meters high. These structures were covered with 14-mesh wire mosquito netting. The intention was to

[1] Waite, M. B., report in Smith, Erwin F., "Bacteria in Relation to Plant Diseases," 2: 55.

[2] Stewart, V. B., and Leonard, M. D., *Phytopathology*, 5: 117–123.

[3] Burrill, A. C., *Phytopathology*, 5: 343–347.

[4] Stewart, V. B., N. Y. (Cornell) Agr. Exp. Sta. Bull. 329.

[5] Stewart, V. B., *Phytopathology*, 3: 273–276.

[6] Stewart, V. B., and Leonard, M. D., *Phytopathology*, 6: 152–158.

[7] Jones, D. H., Ontario Agr. College Bull. 176.

determine whether infection was as abundant under such a cover as in the open. Infection was fully as abundant. Conclusions could not be satisfactorily drawn, however, because it was found that the mesh of screen used was large enough under the conditions to allow the entrance of a large number of very small insects. The conditions of the experiment were, therefore, revised this year with the hope of making them crucial. Twelve-mesh wire screen cylinders, 15 cm. in diameter and 30 cm. long, were constructed to enclose parts of single branches. To prevent contact with the branches to be enclosed, cords were run four times transversely through each cylinder. Some of the cylinders were slipped into closely fitting sleeves of fine bolting cloth (124 threads per linear inch). For durability, the bolting cloth was sewed into canvas which formed the ends of the sleeves, covering the rough ends of the wire, and extending past the wire about 14 cm., sufficiently to permit secure tying. The ends of other cylinders were similarly covered with canvas and the exposed part of the wire was painted with a mixture of tangle-foot and benzene. The cylinders were slipped over branches including either last year's terminal shoots or bearing wood. In the former case the cylinders were extended far enough past the ends of the branches to allow for this year's terminal growth. All this was done before any of the blossoms opened, at the beginning of the pink-bud stage. The cylinders treated with tangle-foot were repainted frequently enough to maintain a sticky surface. No insects and no traces of them of any sort were found in any of the cages with one exception.[8]

There were ten cylinders enclosing flowering wood. Flowers in two of these cages blighted, as was shown by their appearance and as was verified by microscopic examination. The blight evidently entered through the calyx. Blossom blight was not abundant this season in this orchard.

Forty cylinders, twenty of the bolting cloth and twenty of the tangle-foot type, were used to include terminal growth. Of this year's shoots four in the bolting cloth cylinders and eight in the tangle-foot cylinders blighted, a total of twelve in forty, or thirty per cent. This was practically the same proportion of blighted terminal shoots as prevailed among the unenclosed shoots, as was shown by a count of a thousand terminal shoots on these and adjacent trees of the same variety and age.

From the above facts it appears that there must have been some agency of dispersal other than insects, and that insects were not even of primary importance as carriers. The only tenable hypothesis is that wind was the chief agent of transmission. Supporting evidence for this conclusion is found in two facts: (1) in the lack of insects in the orchard in sufficient numbers to account for the large amount of twig blight and (2) in the entire absence of insects from exuding cankers, whence they might receive their initial contamination. In three years' close observation at blooming time one of the authors (Ruth) has not observed a single case of insect visitation to exuding cankers. Aphids were entirely absent through the season of floral and twig infection. Leafhoppers became evident in rather small numbers only after the period of infection had passed. No other insects were present in sufficient numbers to be considered primary agents.

F. L. Stevens,
W. A. Ruth,
C. S. Spooner
University of Illinois

[8] One cylinder was accidentally allowed to dry. Two insects were found in it. The shoot was not blighted.

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science

Published every Friday by

THE SCIENCE PRESS

LANCASTER, PA. GARRISON, N. Y.
NEW YORK, N. Y.

Entered in the post-office at Lancaster, Pa., as second class matter